

Nov. 13, 1923.

1,473,842

L. T. FREDERICK

STRUCTURAL ELEMENT

Filed July 10, 1918

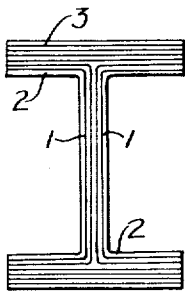


Fig. 1

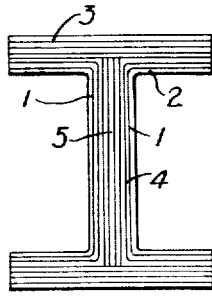


Fig. 2

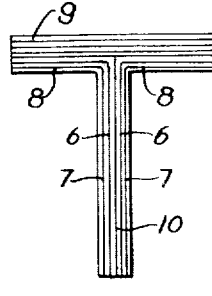


Fig. 3

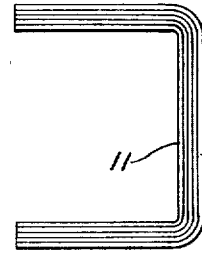


Fig. 4

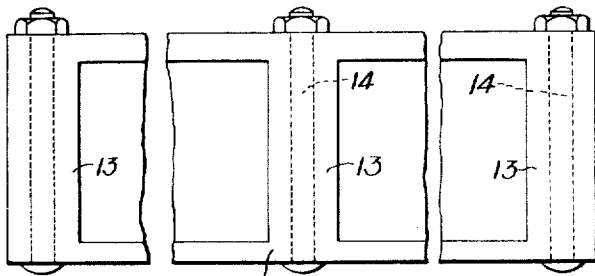


Fig. 5

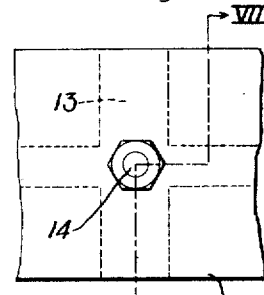


Fig. 6

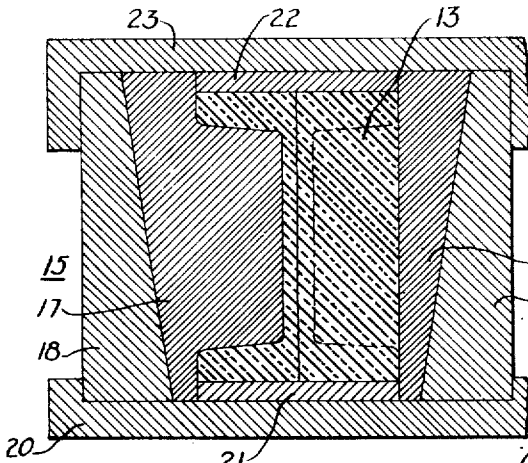


Fig. 7

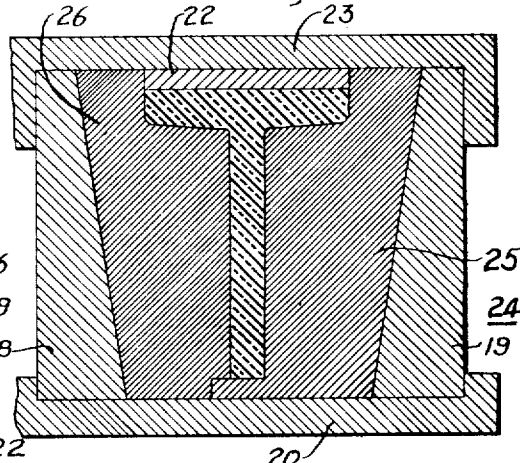


Fig. 8

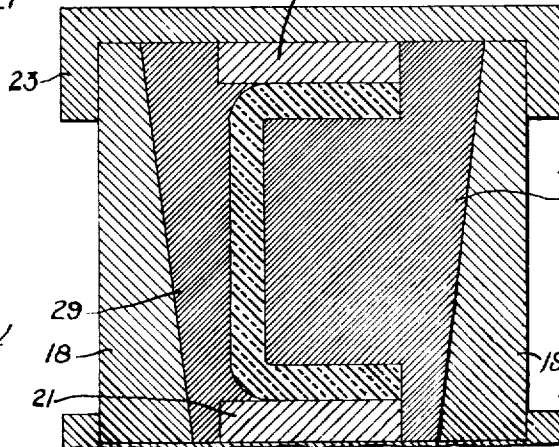


Fig. 9

WITNESSES:

H. B. Funk
O. E. Bee.

INVENTOR

Louis T. Frederick.

BY

Wesley K. Barr
ATTORNEY

UNITED STATES PATENT OFFICE.

LOUIS T. FREDERICK, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

STRUCTURAL ELEMENT.

Application filed July 10, 1918. Serial No. 244,196.

To all whom it may concern:

Be it known that I, LOUIS T. FREDERICK, a citizen of the United States, and a resident of Wilksburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Structural Elements, of which the following is a specification.

My invention relates to structural elements, and it has for its primary object the construction of structural elements, composed of impregnated fibrous material, by a method which will insure a strong and uniform product.

Structural elements, such as I-beams, T-beams and the like, consisting of impregnated sheet material molded to compact and harden the material, are lighter in weight than metal as well as being mechanically strong and are unaffected by temperature changes and by oils and weak acids. For this reason, one object of my invention is to construct beams of the above described character which may be utilized in airplane construction.

Another object of my invention is to provide structural elements which will be non-inflammable and which will offer great resistance to bullet penetration.

A still further object of my invention is to construct structural elements having reinforcing portions formed integrally with the structural elements, at desired places.

With these and other objects in view, my invention will be more fully described, illustrated in the drawings, in the several views of which corresponding numerals indicate like parts, and then particularly pointed out in the appended claims.

In the drawings, Figs. 1 to 4 inclusive are end views of various structural elements, illustrating diagrammatically the disposition of the material employed in their construction, the laminated structural feature being greatly exaggerated to bring out more clearly the method of forming the structural elements. Fig. 5 is a side elevation, parts being broken away, of an I-beam embodying my invention, showing the I-beam with reinforced portions; Fig. 6 is a fragmentary plan view of the beam shown in Fig. 5; Fig. 7 is a sectional view, taken on the line VII-VII of Fig. 6, of the reinforced I-beam enclosed in a mold, embodying my invention, which is also shown in a similar

section; Fig. 8 is a vertical sectional view of a mold embodying my invention and a T-beam also in section enclosed therein; Fig. 9 is a view similar to Fig. 8 showing a slightly modified form of a mold embodying my invention adapted to mold U-beams formed as hereinafter described.

In practicing my invention, I employ impregnated sheets of material which may be properly shaped to preform the structural element of which they are to be a part. The impregnated sheet material, after being formed and stacked in a suitable manner, is surrounded by the pressure members of the mold and subjected to heat and pressure in the mold to compact the preformed material and harden the binder, the manner of shaping and stacking the material depending upon the nature of the structural element desired. It is necessary, however, to determine the thickness of the stacked material required before subjecting it to pressure and heat in order to have the necessary thickness of material when it is compacted. Structural elements which are to be pierced or drilled at certain portions to provide openings for bolts or the like may be reinforced at these portions by placing a predetermined amount of material at these places after the structural element has been otherwise completely assembled. When the structural element having such additional material at certain portions is subjected to pressure and heat in the mold, the material thus added will be molded integrally with the other material employed in forming the main part of the structure.

In Fig. 1 is shown an I-beam preformed preparatory to molding, the web being formed by placing layers of impregnated sheet material bent to form channel or U-shaped elements 1 back to back so that their flanges 2 extend in opposite directions. Flat longitudinal strips 3 of the same material may be stacked against the oppositely extending flanges 2 to thicken and strengthen them.

The I-beam shown in Fig. 2 is preformed in substantially the same manner and its web 4 may be thickened by interposing strips 5, of the same material as is used in forming its U-shaped elements 1, between the U- or channel-shaped elements 1.

The T-beam shown in Fig. 3 may be formed by placing layers of impregnated

sheet material bent to form L-shaped elements 6 so that the engaging portion 7 form the stem and the oppositely extending portions 8 form the head. The head may be thickened and strengthened by stacking flat strips 9 upon it, as in performing the I-beams. The stem may also be thickened by interposing strips 10 between the L-shaped elements. The channel or U-beam 11 shown in Fig. 4 may be formed by stacking a plurality of sheets of treated material bent into proper form.

The material which may be employed in the construction of structural elements in accordance with my invention may be a fibrous sheet material, such as paper, duck or muslin, impregnated with a suitable binder, such as a phenolic condensation product. The sheet material so impregnated will have sufficient rigidity of form to permit shaping the sheets in order that they may be stacked to the form of the structural element desired.

In Figs. 5 and 6 is shown an I-beam embodying my invention which has reinforcing portions 13 in the regions where it may be necessary to employ bolts 14. The reinforcing portions 13 may be inserts of stacked sheet material, of the same nature as that forming the rest of the structure, cut so that they may be put in place and molded integrally with the beam. The reinforcing portions 13 are shown as employed with an I-beam but they may also be inserted in any structural element, regardless of its shape.

The mold 15 shown in Fig. 7 is adapted to mold I-beams which embody my invention, in such manner that the pressure may be exerted from all four sides, thus assuring a uniform structure. The section of the I-beam in the mold is taken in such a manner as to show the reinforcing insert 13 at one side of the beam but not at the other, the splits 16 and 17 of this mold having offsets in those regions where it is desirable to add the reinforcing material. In molding an I-beam, the preformed structure may be disposed between splits 16 and 17, which have suitable recesses to receive the reinforcing portions 13 and the preformed structure and splits may then be slipped between the side plates 18 and 19, of the mold 15, which rest upon, and are held in place by, the bottom clamping plate 20, a bottom forming plate 21 being previously disposed upon the bottom clamping plate 20. The splits 16 and

17 and the top forming plate 22 may then be pressed down between the side plates 18 and 19 sufficiently to allow a top clamping plate 23 to be positioned with its flanges engaging the side plates 18 and 19. Pressure may then be exerted against the top plate 23 to force the inner mold sections into their final positions, as shown in Fig. 7.

The mold 24 shown in Fig. 8 may be employed for molding T-beams and differs from the mold above described in that the splits 25 and 26 are so shaped that the bottom forming plate 21 is unnecessary. The molding operation may be performed in the same manner as for an I-beam. The mold 27 shown in Fig. 9 differs from the mold shown in Fig. 7 only in the shape of the splits 28 and 29, the bottom forming plate 21 being necessary in this case.

Heat may be applied during the molding operation or after the pressure members have been forced into their final positions, as seems most desirable. Although I have indicated and described the construction of structural elements by employing impregnated sheet material, it is obvious that material other than sheet material may be employed. The performing operation is not necessary but facilitates the placing of the material in the mold previous to the application of pressure.

Although I have specifically described and illustrated several modifications of my method and of the apparatus for forming structural elements, it is obvious that minor changes may be made both in the material and treatment thereof and in the shape of the mold elements, I desire, therefore, that no limitations shall be imposed except such as are indicated in the appended claims.

I claim as my invention:

1. In I-beam, U-beam, T-beam or the like comprising a fibrous sheet material impregnated with a hardened phenolic condensation product as a binder.

2. A structural element comprising an impregnated material molded integrally with reinforcing portions of similar material disposed at intervals along the structural element.

In testimony whereof, I have hereunto subscribed my name this 22nd day of June, 1918.

LOUIS T. FREDERICK.

Certificate of Correction.

It is hereby certified that in Letters Patent No. 1,473,842, granted November 13, 1923, upon the application of Louis T. Frederick, of Wilkinsburg, Pennsylvania, for an improvement in "Structural Elements," an error appears in the printed specification requiring correction as follows: Page 2, line 99, claim 1, for the word "In" read *A molded*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 22d day of January. A. D., 1924.

[SEAL.]

KARL FENNING,

Acting Commissioner of Patents.